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NFORMIN' NORMAN

A NUAL REPORT 1955

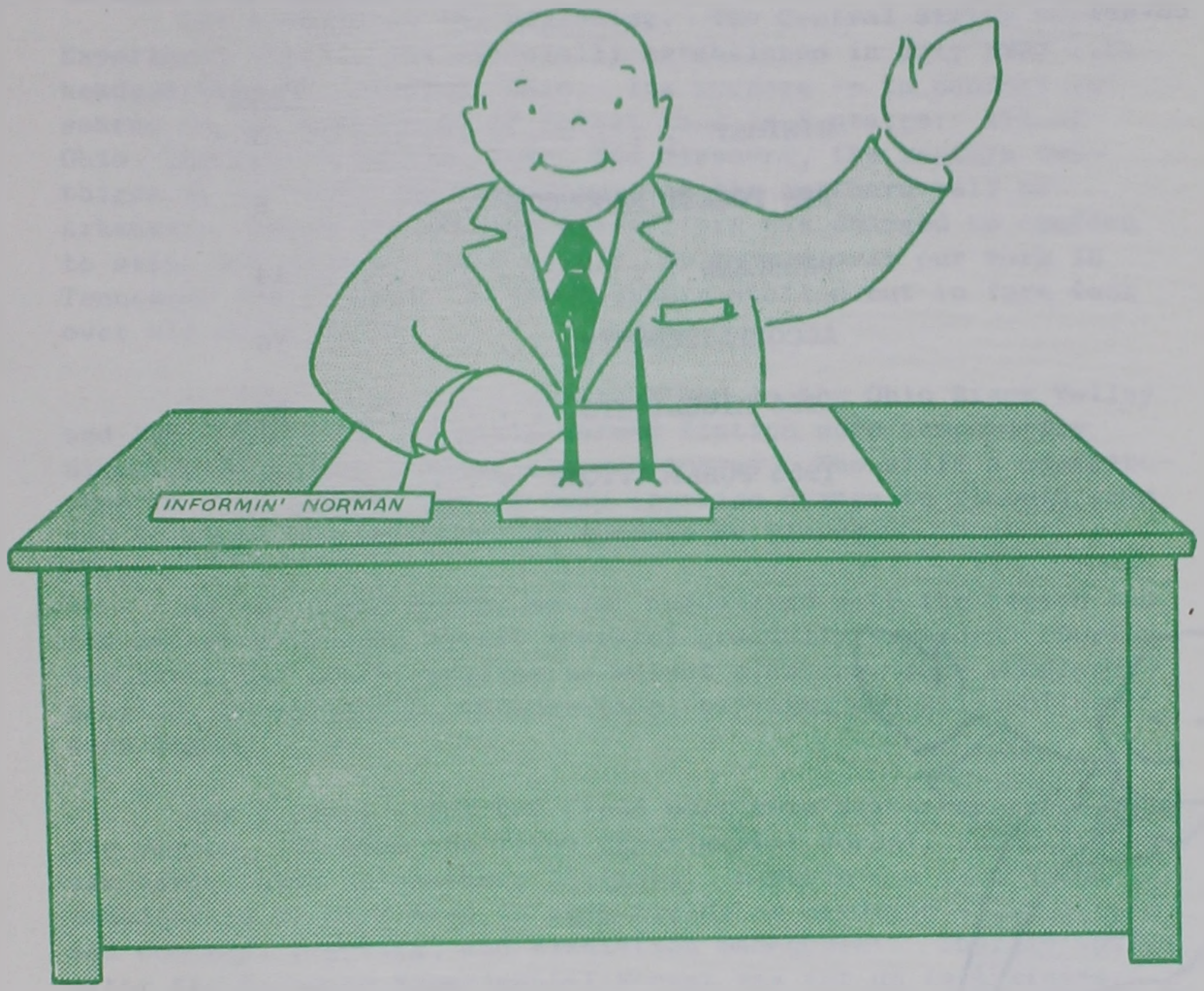
TRAL STATES FOREST EXPERIMENT STATION

DEPARTMENT OF AGRICULTURE - FOREST SERVICE

HI!

My name's Norman. "Informin' Norman" folks call me. I work for the Central States Forest Experiment Station and it's my job to keep you posted on the progress we're making in forest research.

This is the time of year we usually make our Annual Report to our "stockholders." So, if you've got a few minutes, I'd like to help you get better acquainted with our region, our problems, and our work.



Central States Forest Experiment Station
Columbus, Ohio W. G. McGinnies, Director
U. S. Department of Agriculture Forest Service

1955 marked the Golden Anniversary of the U. S. Forest Service -- 50 years of forestry. So, although the Central States Station has been in existence for little more than half that time, we thought this would be a good opportunity to deviate somewhat from the usual annual-report format and give you a little of our history and a quick review of our major activities and accomplishments throughout the years. Then we thought that to round out our story we should report on the forest situation in the Central States. The Forest Service recently took the leadership in conducting a review of the nation's timber resources. This review provides us with the information necessary to highlight the forest situation in the region.

This may sound like a big order, but we've tried to keep it as brief as possible. Here's a rundown of the points we'd like to cover:

History

Let's begin at the beginning. The Central States Forest Experiment Station was officially established in July 1927 with headquarters in Columbus, Ohio. Its purpose -- to conduct research in the management of forest land in 8 states: all of Ohio, Indiana, Illinois, Iowa, and Missouri, the western two-thirds of Kentucky and Tennessee, and the northern half of Arkansas. Later the Station's territory was changed to conform to state boundaries. As a result, we turned over our work in Tennessee and Arkansas to the Southern Station but in turn took over all of Kentucky.

In 1927 there was a severe flood in the Ohio River Valley and the efforts of the newly formed Station were temporarily diverted to making a flood-control survey. The staff's contribution to this project was to help appraise damage to flooded land and to study the influence of forests on floods.

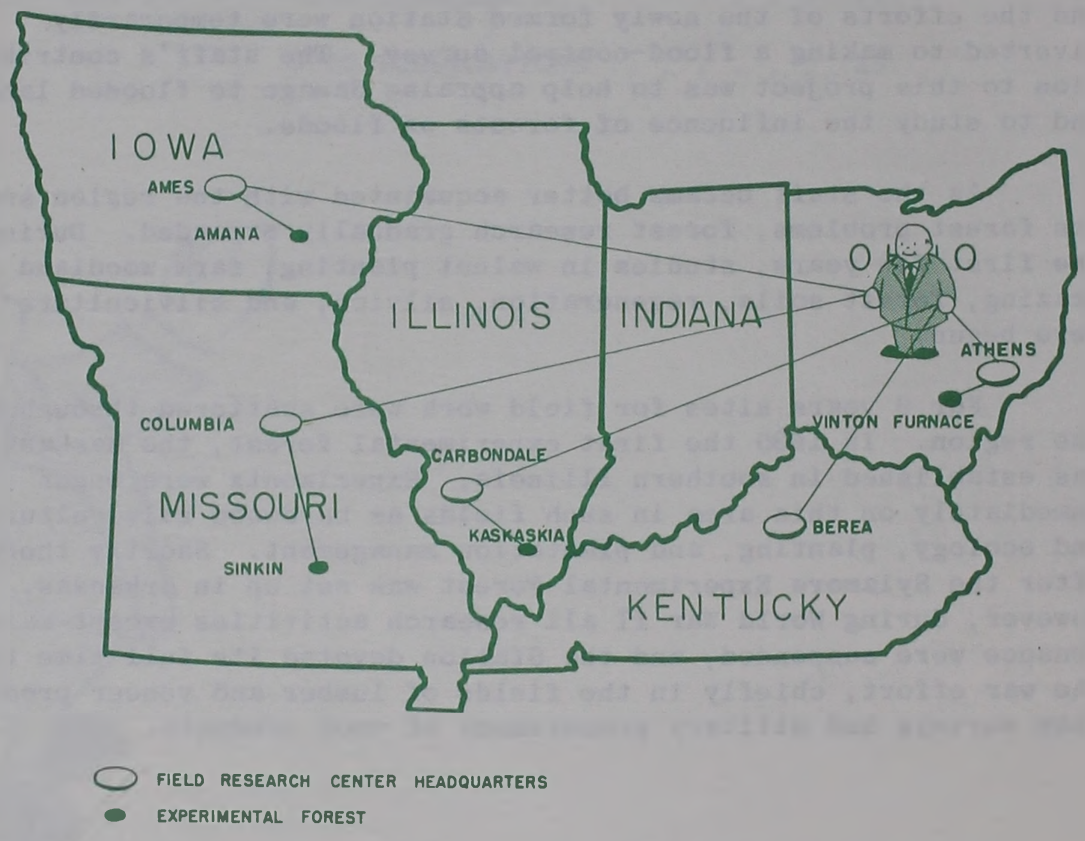
As the staff became better acquainted with the region and its forest problems, forest research gradually expanded. During the first few years, studies in walnut planting, farm woodland grazing, forest soils, regeneration, silvics, and silviculture were begun.

For 9 years sites for field work were scattered throughout the region. In 1935 the first experimental forest, the Kaskaskia, was established in southern Illinois. Experiments were begun immediately on this area in such fields as hardwood silviculture and ecology, planting, and plantation management. Shortly thereafter the Sylamore Experimental Forest was set up in Arkansas. However, during World War II all research activities except maintenance were suspended, and the Station devoted its full time to the war effort, chiefly in the fields of lumber and veneer production surveys and military procurement of wood products.

Shortly after the close of the war, the forest research program in the Central States became so extensive that it was necessary to decentralize the administrative and technical facilities. So a field research center headquarters was set up in Carbondale, Illinois in 1946 (in cooperation with Southern Illinois University) to carry on the work at and in the vicinity of the Kaskaskia Experimental Forest. At the same time another field research center headquarters was established at Ames, Iowa (in cooperation with Iowa State College), to intensify work in farm woodland rehabilitation and management in that area.

Also in the same year, an inventory of the region's forests got underway as part of a nationwide "Forest Survey." This inventory was recently completed and furnished the bulk of the data for the Central States portion of the Timber Resource Review.

In 1948 two more field research center headquarters were established: one in Columbia, Missouri (in cooperation with the University of Missouri), and the other in Athens, Ohio (in cooperation with Ohio University). In both of these sections work had been going on for some time; the centers were established to continue and expand the already going programs from a local level. Also in 1948, we began to do some research in farm woodland marketing.



In 1951 the Sinkin Experimental Forest was established in the Missouri Ozarks to serve as an outdoor laboratory for research in that heavily forested section. The forest functions as part of the Columbia Field Research Center.

In the following 2 years, two more experimental forests were established. The first, set up in southern Ohio in cooperation with the Baker Wood Preserving Company, is operated in connection with the Athens Field Research Center. The second is located in southeastern Iowa on land owned by the Amana Society there and is administered through the Ames Field Research Center.

Finally, late in 1954, our fifth field research center headquarters was established to serve the vast and important forest area in and surrounding eastern Kentucky. Headquarters is in Berea and the work is being undertaken cooperatively with Berea College and the Kentucky Agricultural Experiment Station. We hope soon to set up an experimental forest in the Cumberland National Forest.

As a result of the reorganization of the Department of Agriculture, two new divisions were added to the staff in 1954: forest diseases and forest insects. With the latter we inherited a forest insect laboratory, located several miles north of our Columbus office.

More recently, a Wood Products Pilot Plant was established in southern Illinois in connection with the Carbondale Research Center and in cooperation with Southern Illinois University. The purpose of this plant is to develop and test new ways to use low-grade hardwoods.

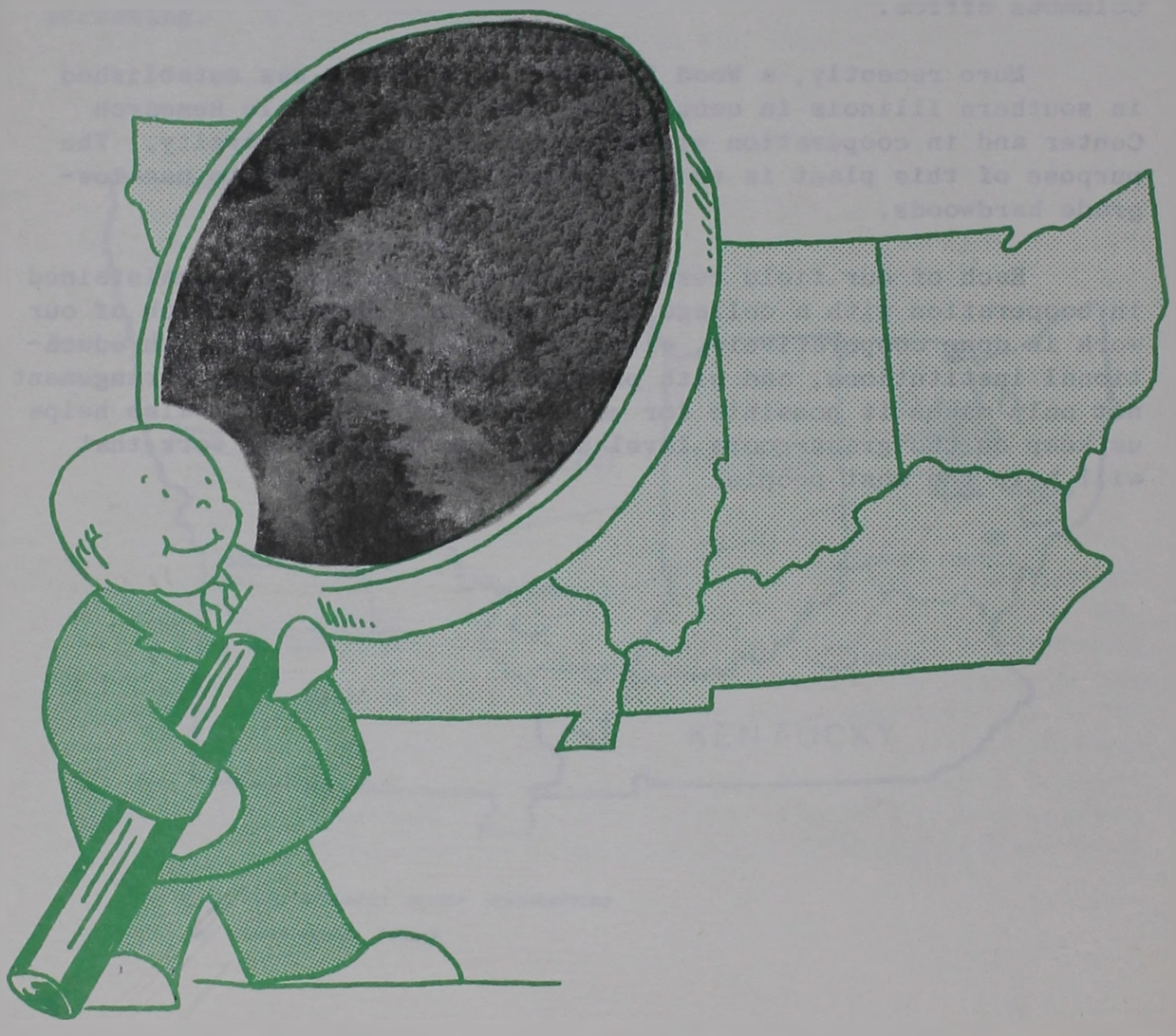
Each of our field research center headquarters is maintained in cooperation with a college or university. Moreover, much of our work is done cooperatively, with other public agencies, with educational institutions, and with private industry. Such an arrangement not only makes it possible for us to do more work but it also helps us keep on the grass-roots level and doing the kind of work that will help the most people.

The Forest Situation

To many people, the Central States region is strictly an agricultural and industrial area. When you mention forests and forestry to them their thoughts immediately turn to the North, South, or West. It is true of course that most people in this 6-state area do earn their livings from farm or factory, but it is also true that the region contains a good share of forest land. About 1 out of every 5 acres of land is forested and capable of producing commercial forest products.

This forest land is playing an ever-increasing role in the economy of the region, not only because of the timber it produces, but also because of the recreation it provides and the watershed protection it affords. The latter feature alone is enough to justify forests, forestry, and forest research in the Central States.

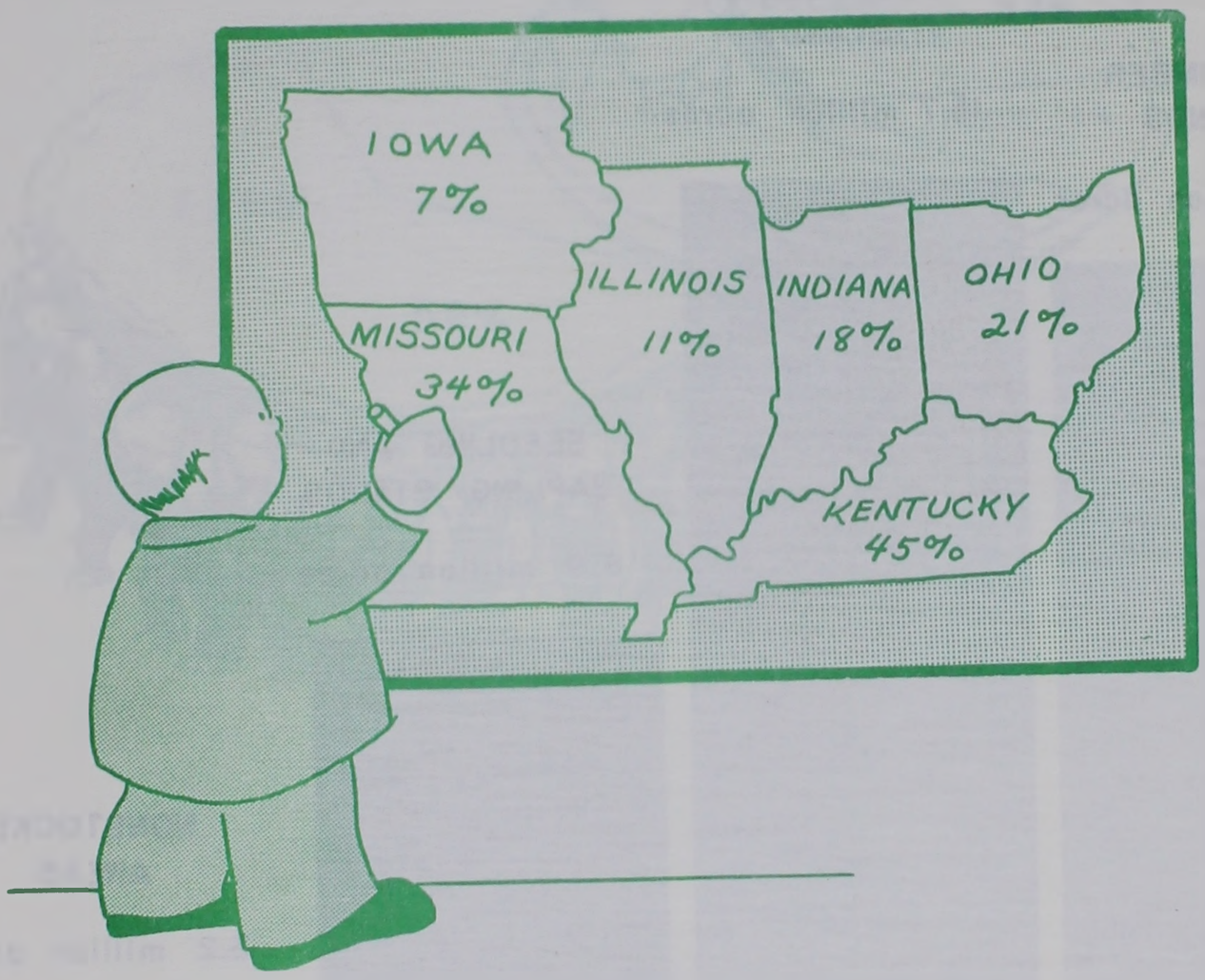
But let's take a little closer look at the timber situation in the region. Just what have we got to work with, anyway?



Forest Area

We've got a lot of forest land -- more than 42 million acres of it. That's more than the entire land area of the 6 New England states. Our two southernmost states, Missouri and Kentucky, are the most heavily forested. Missouri has more than 15 million acres of forest and Kentucky has nearly 11 1/2 million.

The percent of forest land by states stacks up about like this:



Stand Sizes

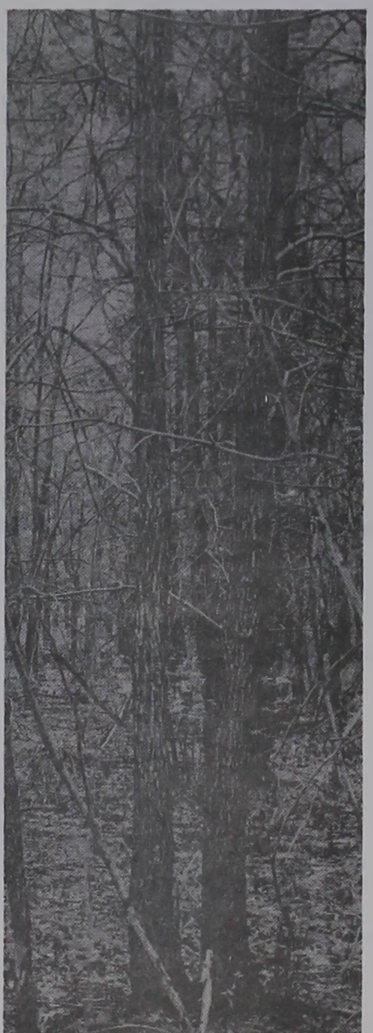
It's one thing to have forest land and another thing to have timber. In order to get a better idea of the amount of timber we're producing, let's divide all the forest land into four classes, depending upon size and amount of timber growing per acre, and see how much of each we have.

SAWTIMBER STANDS

14.5 million acres

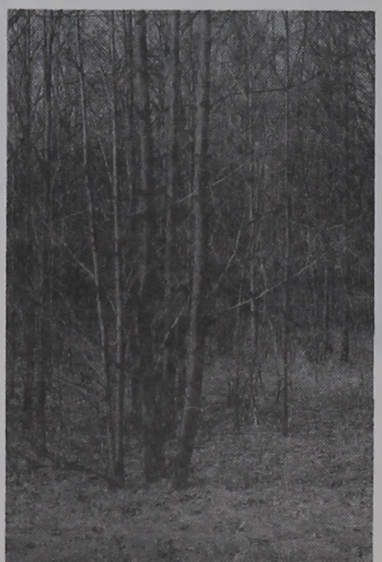
POLETIMBER STANDS

15.7 million acres



SEEDLING AND SAPLING STANDS

8.9 million acres

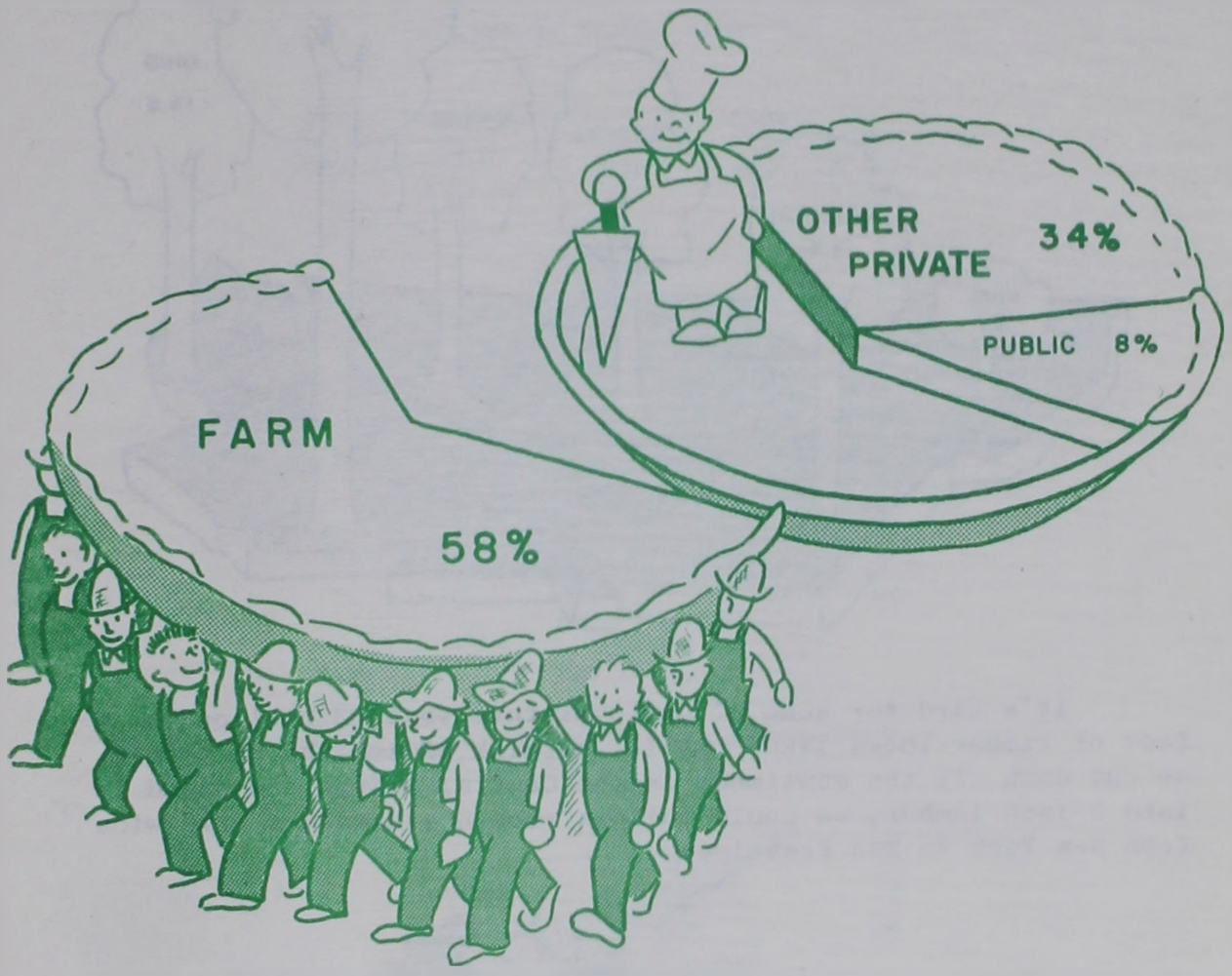


NONSTOCKED AREAS

3.2 million acre

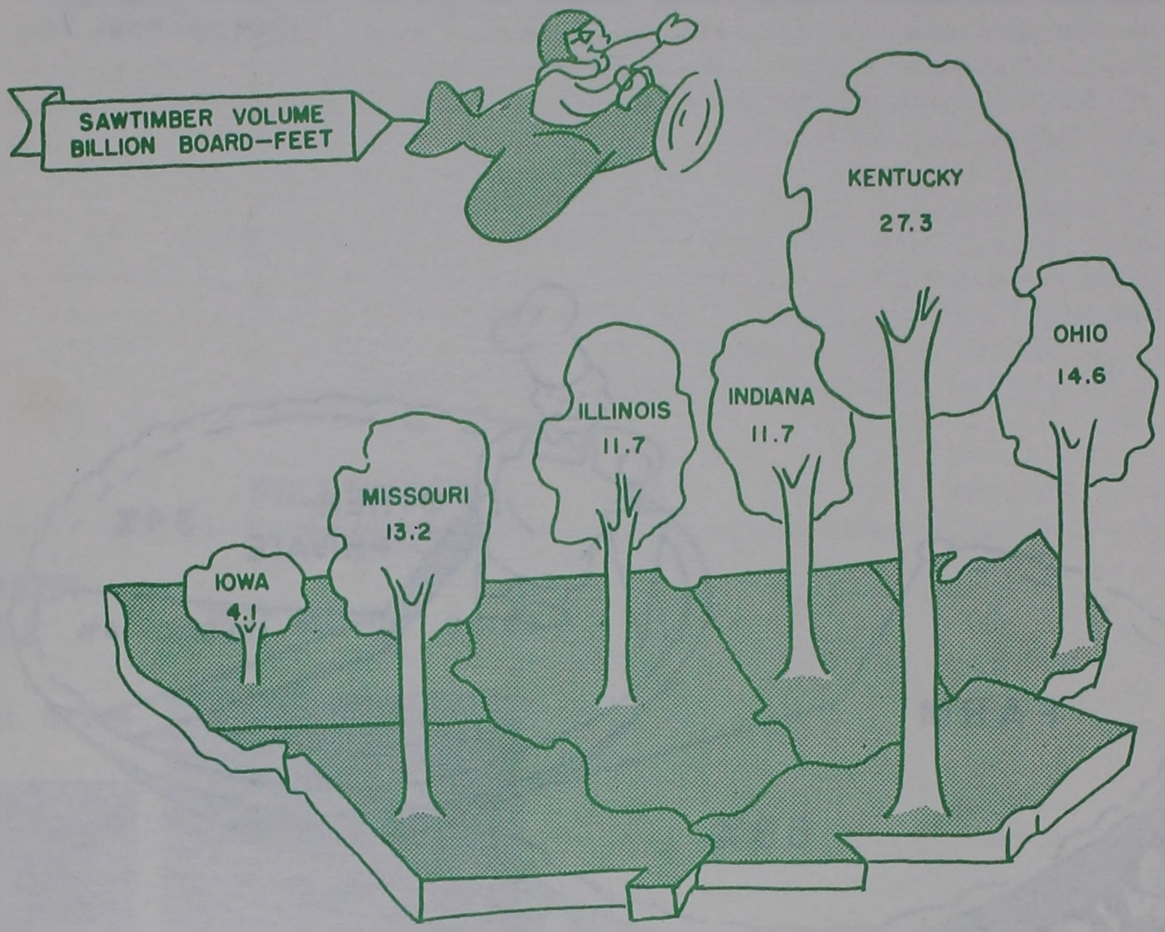
Ownership

Who owns all this forest land? Well, farmers own well over half of it. More than 750,000 farmers own forest land in the Central States, mostly in tracts of less than 100 acres.



Sawtimber Volume

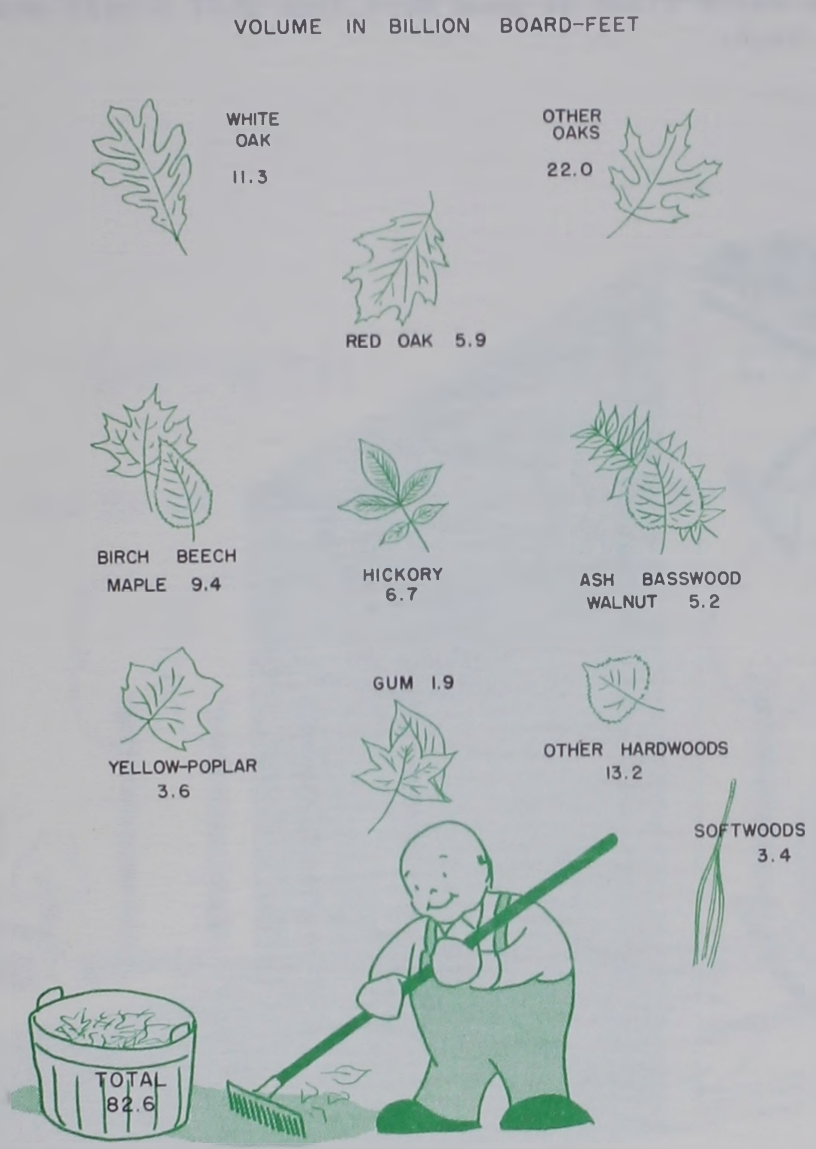
So much for forest area; now, what about timber volume? The Central States region contains more than 83 billion board-feet of sawtimber. The distribution of this volume by states runs about like this:



It's hard for some of us to picture what 83 billion board-feet of timber looks like. So let's think of it like this: If we cut down all the sawtimber in the Central States and sawed it into 1-inch lumber, we could build a wooden sidewalk a mile wide from New York to San Francisco.

Volume by Species

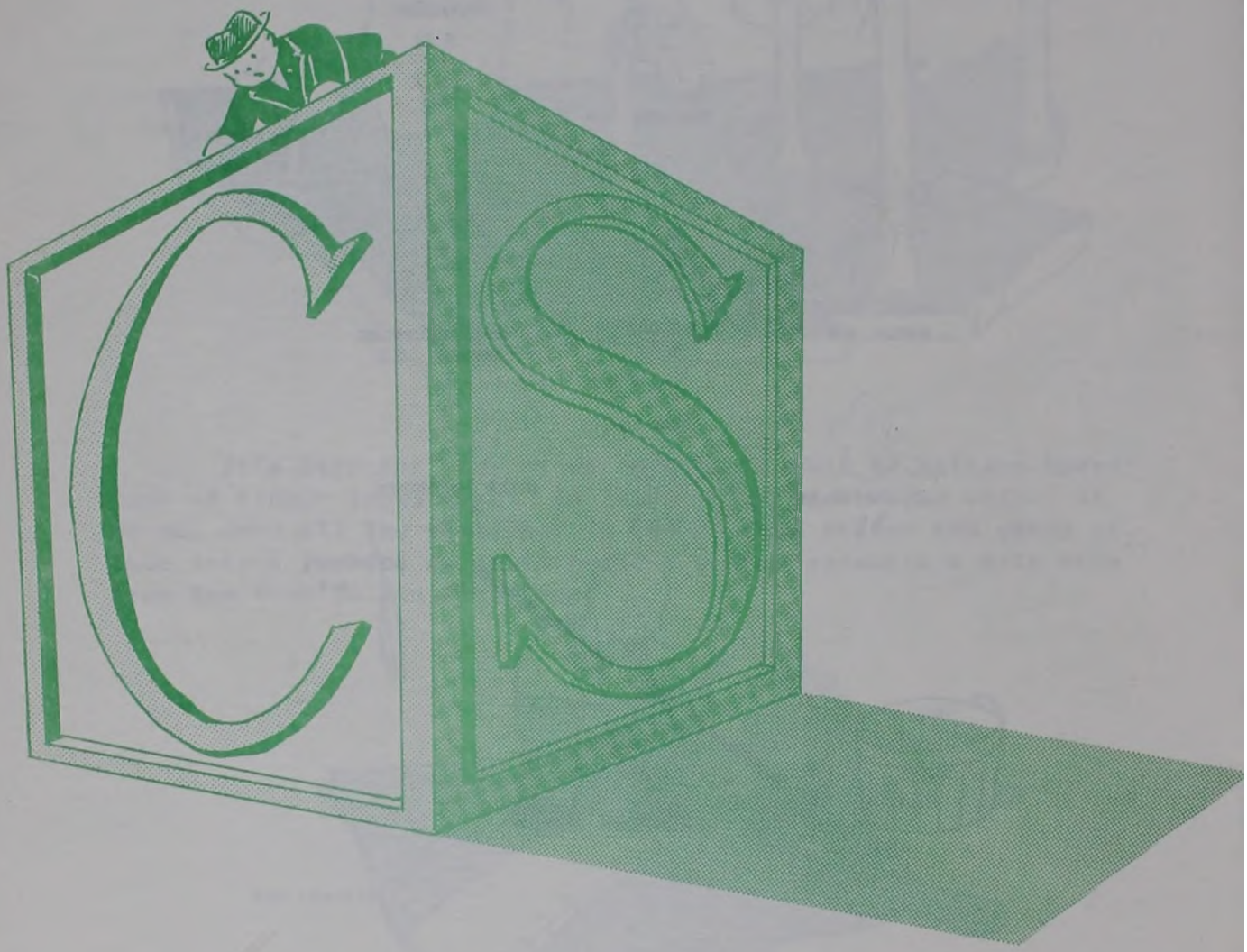
The Central States region is the center of the Nation's hardwood country. Many of our most valuable hardwoods, such as white oak and black walnut, are more abundant here than in any other region of comparable area. About 96 percent of the sawtimber volume found in the area is in hardwood (or broad-leafed) species. The most abundant species group is the oaks, making up nearly half of the sawtimber volume. Included is more than 11 billion board-feet of white oak, one of the most sought-after hardwood species in the country.



Cubic Volume

So far we have been talking about volume in terms of board-feet of sawtimber. In other words, the amount of lumber that could be sawed from trees about 11 inches in diameter and larger. But many wood products are made from trees smaller than this. So in order to get a better idea of how much usable wood there is in the region, let's switch to cubic feet and consider all merchantable trees down to 5 inches in diameter.

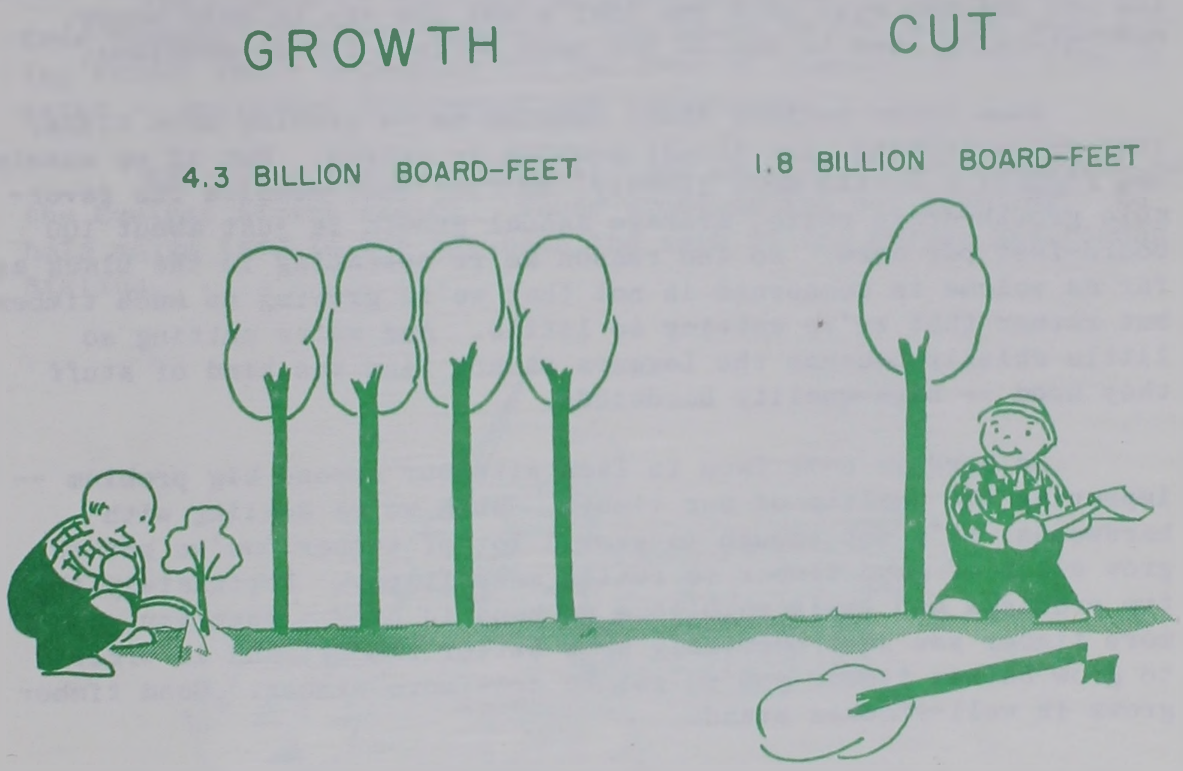
There is more than 24.6 billion cubic feet of wood in the Central States in trees 5 inches in diameter and larger. This would make a solid block of wood more than half a mile square and half a mile high.

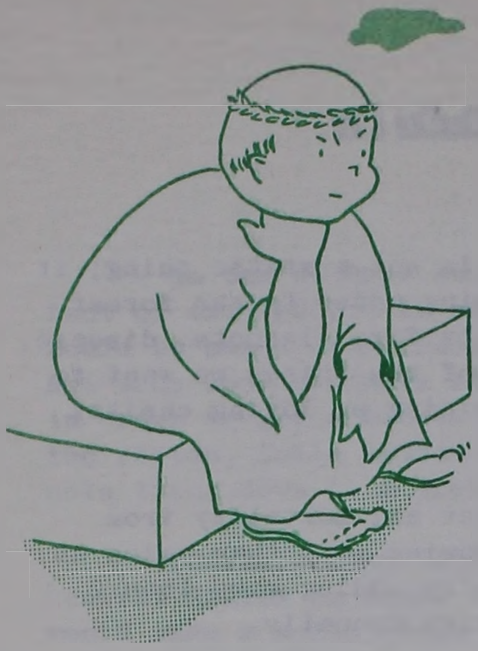


Growth and Drain

Trees grow. So a timber inventory is not a static thing; it is always changing. Wood is constantly being added to the forest by growth and constantly being taken away by fire, insects, disease, weather, and of course, cutting. But one of the things we want to know is what is the net change. Are we gaining or losing capital stock?

In the Central States, if we subtract all mortality from total growth, we find that we are still growing more than twice as much wood in a year as we are cutting. We're adding more than 2 billion board-feet of volume to our inventory annually.





Problems

The figures we've just looked at point to our major forest problems. For instance, we have 42 million acres of forest land supporting 83 billion board-feet of sawtimber. That's about 2,000 board-feet per acre. Now 2,000 board-feet isn't much to be growing on one acre. In fact, the average acre of forest land in the Central States is capable of supporting more than three times that amount. So in effect we're carrying a 3-ton load in a 10-ton truck, and any shipper will tell you that's not the way to make money. Understocking then is one of our most serious forest problems.

Some folks believe that, because we're growing more timber than we're cutting, the forest problem is solved. But if we examine the figures a little more closely, we find that despite the favorable growth-drain ratio, average annual growth is just about 100 board-feet per acre. So the reason we're operating in the black as far as volume is concerned is not that we're growing so much timber, but rather that we're cutting so little. And we're cutting so little chiefly because the loggers cannot find the kind of stuff they need -- high-quality hardwoods.

So here we come face to face with our second big problem -- improving the quality of our timber. When we're dealing with hardwoods, it's not enough to grow a lot of timber; we've got to grow a lot of <u>good</u> timber to really make it pay. Fortunately the two problems and their solutions go hand in hand. When you grow more timber you just naturally grow better timber; and in order to grow better timber you've got to grow more timber. Good timber grows in well-stocked stands.

It's easy to tell the forest landowner that he should grow better timber. But in order to make room for high-quality trees, he has to get the poor stuff out of the woods. And, what many of us sometimes overlook, he has to make a living while doing it.

This then is another one of our problems: Finding ways to use low-grade hardwoods. Actually this is a three-fold problem. It is a problem in marketing, a problem in utilization, and a problem in logging.

And finally there is the matter of forest ownership. Wherever forests occur and are owned in scattered, small blocks, the ordinary management problems become more complex and some unique ones arise. Then there is the added problem of getting the necessary information to these many landowners and convincing them that they should use it.

Along with these "major" problems we have of course a number of important related ones. There is the problem of reforesting denuded land, such as strip-mine spoil banks, and the problem of getting new trees started in an old forest, either by natural or artificial means. We call these regeneration problems.

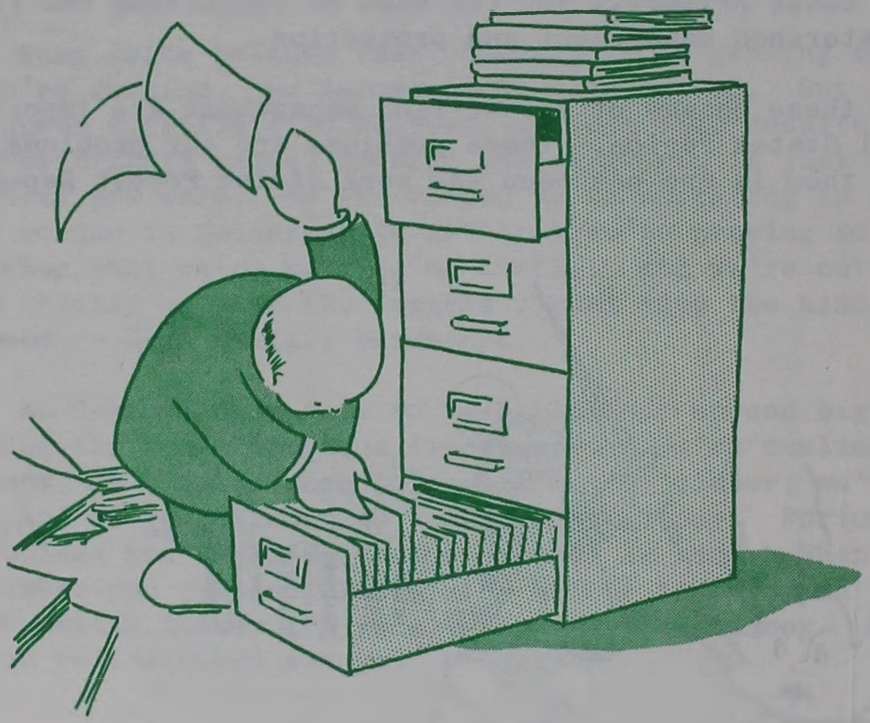
Then there is the task of protecting our forests from fire, from disease, and from insects. And there is the job of maintaining forest cover primarily for the sake of regulating the flow of water -- watershed management and protection.

All these phases of forest land management are important in the Central States region. These problems are our problems. To help solve them is and has been the work of the Forest Experiment Station.

Accomplishments

Forest research is slow work. In other fields of research results often can be observed and conclusions drawn in relatively short periods of time. The chemist can sometimes test a theory in a matter of weeks or even days. Even the agronomist can see good progress in a year or two, because the plants he works with usually complete their life cycles in that time. But the forester deals with life's slowest growers and longest livers, and he must gage the progress of his experiments accordingly.

Our publications reflect our progress. In January 1955 we published a revised list of everything we published to that date. The publications listed contain the fruit of our efforts in every field. Many of these publications are still available for free distribution. We would be happy to fill requests for back numbers as long as our supply lasts. Meanwhile, let's just glance briefly through the files and list some of our major accomplishments.



FOREST MANAGEMENT

We have done most of our work and made most of our progress in the broad field of forest management. This field includes silviculture, silvics, genetics, forest measurements, regeneration, and strip-mine reclamation as well as forest management in the strictest sense.

Many of our studies in silviculture have been aimed at finding out how our hardwood stands respond to various cultural treatments. We have learned quite a bit about pruning, thinning, and improvement cutting in hardwood stands of all ages. We know that hardwoods do respond to these treatments, sometimes remarkably well. We know that many of our more valued hardwood species are capable of rapid growth, given the proper conditions and treatment. But we have also concluded that some of our poorer hardwood sites can and should be converted to pine, and have done a good bit of work along that line.

Other studies have shown that some small tracts of timber such as farm woodlands can be improved at a profit. This means that the timber owner can reverse the usual trend by cutting the poorest instead of the best in order to improve the average, and still make a little money while doing it.

Reforestation is another field that we've been studying pretty thoroughly for some years. We have tried various species (both softwoods and hardwoods), various planting methods, spacings, and so on. We've studied the role of black locust as a nurse crop in plantations. Extensive experiments in direct seeding have led us to the conclusion that this method of getting a new forest started is risky at best and probably should be used only to supplement other methods.

As the many forest plantations in the Central States region become older and begin to mature, the problem of how to manage them will become increasingly pertinent. Anticipating a need for such information, we have been carrying on experiments in plantation management for several years. We have been finding out such things as how to control insect infestations in these stands (a problem that is greatly multiplied in extensive, even-aged, pure stands), when to thin, and how much to thin. As our own experimental plantations grow older, we will of course be able to learn more and more from them.

A special and important phase of our reforestation work has had to do with strip-mine reclamation. Although the total area of land disturbed by strip mining for coal is not great, the problem of how to stabilize the spoil banks and establish new vegetation on them has been of great local concern. We have found that successful plantations of several species of trees can be established on much of the strip-mined land within reasonable periods of time. However, we also found that if the spoil banks are laid down in such a way that concentrations of acid-forming sulphides occur near the surface, it is very difficult if not impossible to grow trees on the site, at least for several years. So in order to help reduce the amount of such sulphides being thrown up on bank surfaces, we developed a practical method for identifying overburden layers having concentrations of acid-forming sulphides. Fortunately, the amount of "unplantable" land is not large. The success of our work in this field has encouraged the coal industry to undertake an extensive reforestation program of its own and much progress has been made along this line.

FIRE

Since most of the forest fires in the Central States region occur in the southwestern part of the region, our research in fire prevention, control, and effects is centered there. A significant accomplishment in this field has been the careful and realistic appraisal of the reasons for the higher rate of burning in that section. The local philosophy concerning forest fires in the past has ranged from indifference (Why worry, fires don't do any harm anyway) to actual approval (Let's burn off the woods to make better forage). From this, it is evident that those phases of fire research that will contribute directly or indirectly to the prevention of uncontrolled fires should have an important part in the fire research program.

So as a first step toward finding better ways to control fires we tried to find out just when they are most likely to occur. Our studies reveal that the number of fires varies with the fire danger. This means that we can predict fairly accurately from fire-danger readings when fires will probably break out. Such foreknowledge helps the fire-suppression organization to decide when to man its towers and to determine the optimum strength and most strategic locations for its stand-by fire crews from day to day.

Fire research is also important to better land use in this area. We are contributing to this phase of the problem by studying the effects of fire on trees and other vegetation, soil, and watershed.

SOILS

Studies of forest soils were begun early in the Station's history and have been continued almost without interruption throughout the years. Some work was done on the characteristics of soils supporting old-growth yellow-poplar. The soil requirements of the major hardwood species (yellow-poplar, white oak, black walnut, and others) have been investigated and cataloged. The relationship of root growth to depth of soil horizon, distance from bole of tree, and physical characteristics of the soil, and the role of root channels in water infiltration have been studied. Methods for determining site quality by examining and measuring the soil profile have been devised. More recently studies having to do with soil-water relationships have been begun.

RANGE

Some of our earliest work was concerned with the effects of woodland grazing upon the trees. We found that very close grazing, as commonly practiced in some areas, results in several detrimental effects. In the first place, the browsing animals destroy or injure many young trees and so prevent the development of adequate reproduction. Moreover, the trampling of the cattle compacts the upper layer of soil thereby decreasing the amount of air and water available to the tree roots. And finally, field tests showed that forage grown in woodland shade contained much less in the way of nutrients than forage grown in open pasture.

These results and conclusions hold true chiefly for small, fenced woodlands. In larger forest areas where open range is common, the grazing-forestry problem is not so one-sided. This is especially true in Missouri where livestock production is a major means of livelihood for rural people.

Here the first thing to be decided is whether a specific area is best suited to growing trees or cattle. Much of our grazing work in this section has been devoted to finding ways to increase the forage and eliminate undesirable woody plants. The best way to kill brush and small trees is to poison them (ammate, 2,4-D, 2,4,5-T). Basal sprays have been found most effective, although foliar sprays are probably best for large areas.

It has also been found that grazing the forests will do little damage to the trees if the forage is not overgrazed.

MEASUREMENTS

Another one of the Station's early projects was to develop locally applicable volume tables for all the commercial tree species. Many of these tables were published, distributed and used throughout the Central States and surrounding territory.

Also in the field of forest measurement we have developed several tools for more easily and more accurately measuring tree heights, diameters, growth, and so on.

ECONOMICS

The biggest job to be carried on in the field of economics has been the Forest Survey. For the past 10 years our survey crews have been taking inventory of the region's forest resource, state by state, county by county. This tremendous task has resulted in the most accurate appraisal of the forest situation that we've ever had in the Central States. The highlights of this survey were presented earlier in this report.

Since it has been estimated that 2/3 of the cost of lumber goes into marketing, anything we can do to make it easier and cheaper to market forest products will benefit both the timber producer and the public. The Station has helped make timber market surveys in the Missouri Ozarks, southern Illinois, Kentucky, and Iowa to better inform the timber owner about potential markets. Directories of timber buyers have been published, others are in preparation.

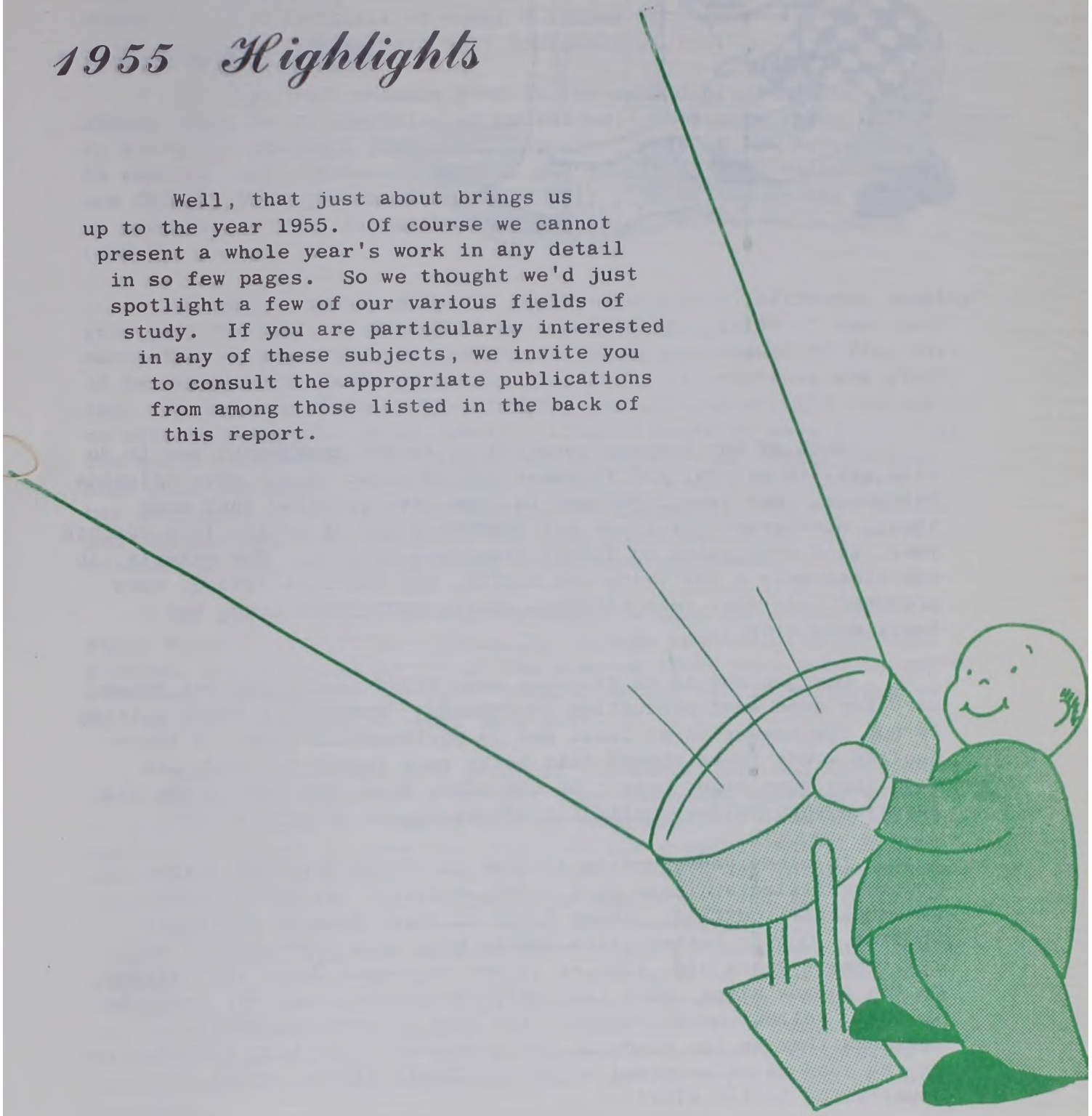
We made a special study in Missouri of the pine resource and markets. The study revealed that there was a lot of pine in the Ozarks that wasn't being used. An expanded market for posts and poles seemed desirable. Since publication of our results and recommendations, the pine post market there has expanded more than one hundredfold.

AERIAL PHOTOGRAPHY

Aerial photography played an important part in our forest survey work. A by-product of this work was the development of several new and improved techniques and tools for handling and interpreting aerial photos. As our final contribution to this field, we recently developed and published a simple yet effective test for stereoscopic perception, which has met with enthusiastic approval wherever aerial photos are used.

1955 Highlights

Well, that just about brings us up to the year 1955. Of course we cannot present a whole year's work in any detail in so few pages. So we thought we'd just spotlight a few of our various fields of study. If you are particularly interested in any of these subjects, we invite you to consult the appropriate publications from among those listed in the back of this report.



Management

Much of our current research in forest management has to do with getting natural and abundant reproduction of our more valuable hardwoods. Our investigations in Iowa have revealed that even though open-grown oak trees may produce a lot of acorns in a certain year, seed production on forest trees may be poor. For example, in one stand only a few white oak acorns, all weevil-infested, were produced this past year although nearby open-grown trees had a heavy seed crop.

Our job now is to find out what crown conditions are necessary for good seed production in forests. Apparently heavy cutting is not the answer -- at least not in southeastern Ohio. A reproduction study there showed that heavy cuts result in fewer oak seedlings than light cuts. On the other hand, the same study also revealed that yellow-poplar reproduces better in open stands.

In other reproduction studies in upland hardwood stands in southern Illinois, there were 5,500 seedlings per acre 4 years after partial cutting. About 3,000 of these were of desirable species. On the better sites nearly half this reproduction was less than 4 years old, that is it had developed since the cutting. On the poorer sites, more than half the reproduction was new. As in Ohio, yellow-poplar reproduction came in more abundantly in openings than in the shade of the overstory. The best reproduction on the good sites occurred on the northerly slopes, which are usually the better sites.

The importance of adequate soil moisture to the growth of reproduction was demonstrated on one experimental area in Missouri. Height growth on some young pine seedlings remained fairly constant from April 7 to July 7. During the following month, an unusually heavy rainfall of about 8 inches occurred and the seedlings responded immediately with increased growth.

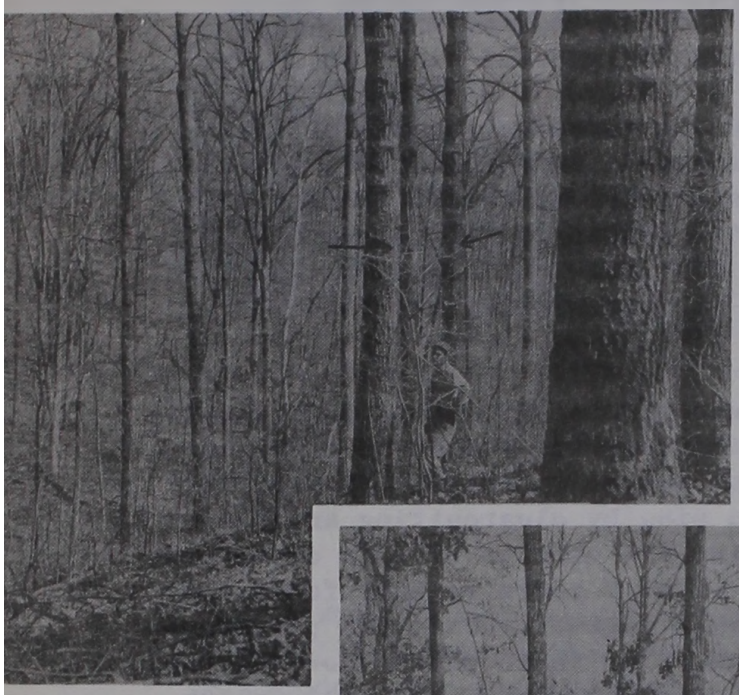
The role that rodents play in the reproduction of oak stands seems to be something of an enigma. In stands where litter is heavy and provides good cover for mice, most of the acorns may be carried away. However, many of the seedlings that do develop are thought to have come from seeds that were buried in the soil by rodents. A more intensive study of this problem was begun in 1955.

On many ridgetop sites in southeastern Ohio, hardwoods usually grow very slowly. In an effort to increase the yields of wood products from these sites, we are conducting an experiment to find out if we can convert hardwood stands to pine by clearcutting and planting. At the same time we are studying the effects of this conversion on soil moisture and water runoff. After 2 years we have found that the soils in clearcut conditions remain wetter over longer periods than soils in uncut plots. Water runoff on these plots, however, has increased as a result of cutting the hardwoods. We will follow the changes that take place as the pine grows but it is too early to evaluate the success of these conversion plantings.

In another stand-conversion study in Iowa where the overstory was killed with herbicides and various species of hardwoods planted, survival and growth of the planted trees were good in spite of a hot, dry summer. In fact, several of our hybrid poplars grew to a height of nearly 11 feet in 1 year.

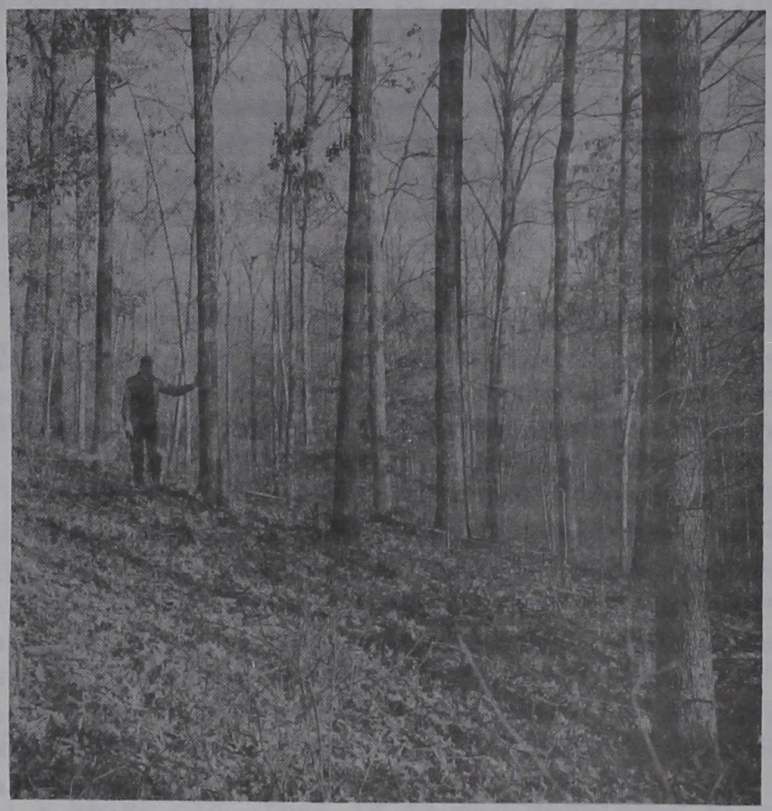
Recently we have been studying the occurrence and development of branches from previously dormant buds along the boles of oaks in an attempt to find out how to prevent such growth. In a series of sprout oak stands in Iowa that had been cut 4 years, we found that more of these "epicormic" branches occurred on trees in open stands than in dense stands, more occurred on codominant and intermediate trees than on dominant (except those that became dominant after cutting), and more occurred on multiple-stemmed sprouts than on single stemmed. We are now making similar comparisons in uncut stands. Ultimately we hope to be able to make some recommendations as to the optimum stocking necessary to minimize epicormic branching. So far it appears that it will be necessary to make a compromise between cutting for maximum growth and cutting for minimum epicormic branching.

FOREST OWNER'S CHOICE



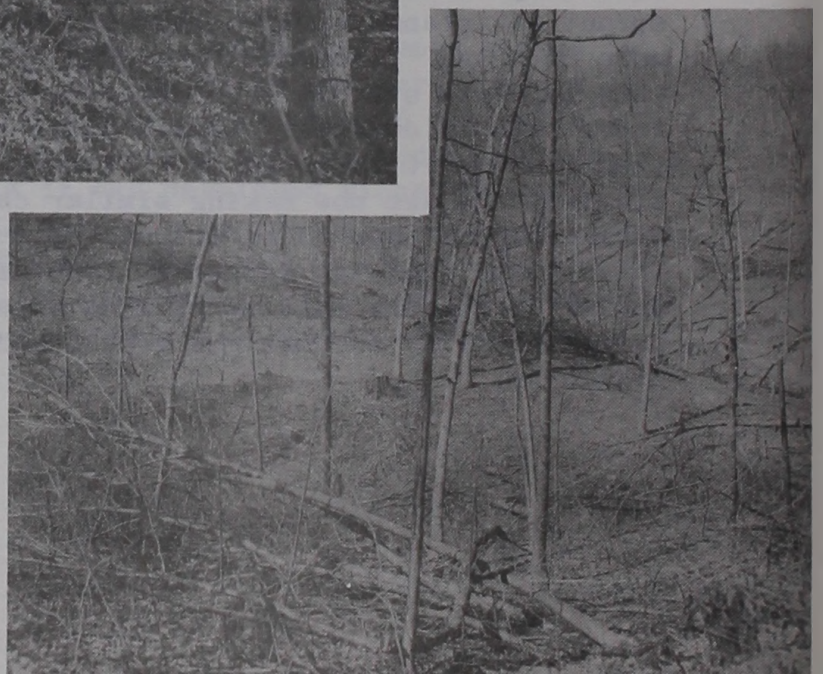
FROM THIS...

This unmanaged stand contains plenty of trees and is capable of good growth. However, about half the merchantable volume is in low-quality and mature trees which should be cut at once. In addition, there are more than 30 cull trees per acre, mostly smaller than sawtimber size, which should be killed. Some examples of trees that should be cut are marked on the photo.



... TO THIS?

A stand similar to the one above 5 years after a heavy improvement cut. These trees are the good growing stock remaining after the low-quality and mature merchantable trees were cut and the cull trees killed. This stand grew nearly 35[illegible] board-feet per acre per year during the 4 years after cutting. A second cut can be made here within a few years.



... OR THIS?

A stand similar to those above immediately after all merchantable volume had been removed. The only trees left are culls and those too small to be merchantable. It will be many years before a second cut can be made here.

One of the ways to make it profitable to log low-grade timber is to reduce the cost of logging. And one of the ways to do this is to select the best combination of equipment for a particular job. Trouble is, very little precise information is available as to the capabilities of various sizes and kinds of logging equipment. In an effort to provide some of this much-needed information, we are conducting a series of experiments in southern Illinois to investigate all phases of the skidding operation.

Preliminary results show that (1) return-trip time (empty run) is not influenced by tractor size or skidding attachments, (2) bunching time for a given volume of logs is less for large logs than for small ones, (3) for a 43-horsepower track-type tractor, optimum load for ground skidding over a level skidroad is about 660 board-feet (for oak logs), but optimum load for the same tractor over an unprepared trail is only 510 board-feet, (4) size or number of logs in a load of given weight have no effect upon the tractive effort required to move the load, and (5) on level terrain, sulky skidding requires less tractive effort than ground skidding for loads greater than 500 pounds.

Careful loggers have long been concerned over the amount of damage done during logging to trees that are not cut. However, until recently we have known very little about the kind and extent of such damage. Experiments in southern Illinois have given us some facts this year about the logging injury caused by skidding. We tried various methods of skidding and we used various kinds of equipment. Here is what we found out:

1. For both log-length and tree-length skidding, and regardless of equipment used, skidding injury occurs chiefly on sapling-sized trees. Few pole and sawtimber trees need be injured.

2. Bunching with a sulky or an arch will disturb the least area of ground and will injury the least number of trees per thousand board-feet bunched.

3. There is very little difference between log-length and tree-length skidding as far as their influence upon over-all stocking of the residual stand is concerned.

Fire

In our forest-fire research we have begun a comprehensive survey of the kinds and amounts of forest fuels found in various types and sizes of timber. As a starter, we compared the amount of litter produced annually by 38-year-old pine stands of two different densities. In one stand that had been thinned to 60 square feet of basal area there was about 1 ton of litter fall per acre. In a similar unthinned stand containing 173 square feet of basal area there were 2 tons of litter fall per acre.

A Cumulative Burning Index was devised to measure the added fire danger caused by drought. A study to see how fire occurrence and area burned were related to these index figures showed that the current fuel moisture, wind velocity, and burning index are still good guides to the probability of fire, the rate of spread, and the chance for a fire to escape. In spring, the Cumulative Index had little correlation with rate of occurrence. The rate increased with the Index in the fall up to an Index of about 200. It was well demonstrated, however, that when the Index is greater than 200, fires get out of hand easily and the situation becomes very critical, particularly when visibility is severely reduced. Indexes above 200 certainly call for publicizing, alert detection, and a ready organization.

Range

The range problems in the Missouri Ozarks are closely related to many forest-management and fire-control problems -- in fact, they are the cause of some of these forest and fire problems. The foremost problem for range research, therefore, is to find the rightful place of range grazing in the Ozark economy and to correlate it with other uses of the land. This broad land-use problem is too big to attack directly; it must be solved bit by bit. Since most Ozark rangeland is privately owned solutions that offer some tangible economic reward to the landowner are much more likely to be used than are solutions that offer only intangible or, at the most, remote economic gain. Although the ultimate aim of all range research is to achieve good land use, it may be necessary to progress gradually through various stages of "acceptable," but not necessarily the best, land use in order to provide a more rewarding path for the landowner to follow.

Forage is the primary resource on about half a million acres of "glades" in southwestern Missouri. Forage production on some of this land is being reduced by the invasion of short-boled, bushy redcedar. In 1952, a portion of these glades was "control burned" in an attempt to stop this invasion by redcedar. Burning killed most of the small redcedar trees but only a few of those more than 6 feet tall. Also burning followed by drought with its consequent close grazing greatly reduced the stand of little bluestem. Little bluestem that was burned but not grazed afterward came through three dry summers with comparatively little density loss. It is apparent from these findings that burning alone is not a satisfactory control for cedar and that little bluestem can take about the worst nature has offered recently in the way of drought only if protected adequately from overgrazing.

Insects

Our current work in the field of forest insects is just 2 years old. During this time we have completed an extensive survey of the kind and amount of damage done to hardwood logs in southeastern Kentucky. The study revealed that oaks suffer more insect injury than any other species. It showed also that older trees are more susceptible to insect attack than younger ones. In addition, we found that extensive insect damage may be present in a log that shows no external evidence of previous infestation.

We have been involved in oak wilt disease work because it is thought that insects may be carriers of the fungus. This year we developed a technique for testing groups of oak insects for oak wilt fungus. First, we macerate insect carrier suspects in distilled water and inject this material into disease-free black and scarlet oak trees. If the insects contained the oak wilt fungus, the injected trees develop the oak wilt disease. We also discovered that oak bark beetles emerging from oak wilt killed wood carry viable spores of the fungus without first contacting oak wilt fungus mats.

In another study, we deliberately wounded 100 black and scarlet oak trees each week for 12 weeks beginning on March 29 and ending June 14. To date oak wilt has developed in 7 of these trees; all 7 were wounded during the last 2 weeks in April. Apparently the oak wilt fungus can enter a tree through a fresh wound, and the time of wounding may influence the incidence of infection.

Also during the year we successfully recovered the European sawfly virus from air-dried and ovendried sawfly larvae, and were able to control European pine shoot moth with modified DDT spray formulas.

The culprit

... and the crime

TESTING AN INSECTICIDE

Red and scotch pine are two of the tree species most commonly planted in the Central States. Unfortunately, both species are very severely attacked by the European pine shoot moth. This insect causes so much damage in fact that several states are considering abandoning these two pines in their planting work unless an adequate control for the shoot moth is developed.

Previous experimental work has revealed that the insect can be controlled by DDT sprays, but as yet the method of application is so costly and the results so uncertain that it is not practical to attempt control in large plantations. Recently we have been testing various methods of formulating and applying these insecticides in an effort to develop a practical and economical control. The accompanying photos show how we go about testing a particular spray. Results so far have been very encouraging. In a year or two we hope to be able to make some definite recommendations.

Attack

Reconnaissance

Did we get 'em?

Diseases

Our work in forest diseases is also new. So far we have been concentrating our efforts in this field on the oak wilt disease. Control of this disease is of great importance if a serious threat to the oak timber of the country is to be overcome.

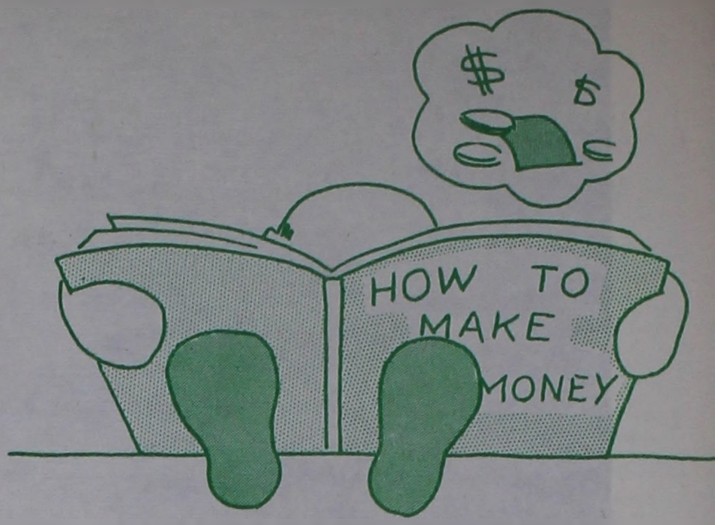
A cooperative study with the Southeastern Forest Experiment Station on the longevity of the oak wilt fungus in lumber was completed this year. The fungus lived in 1-inch red oak lumber for 18 weeks, but was not isolated from boards having a moisture content of less than 20 percent. At the time of felling the sample trees, the fungus occurred in the outer sapwood layers only. However, after the lumber cut from these trees had been air dried for 2 weeks, the fungus had penetrated the sapwood to a depth of 1 inch.

One of the first problems to be solved in controlling oak wilt is how the disease is transmitted. We investigated the possible dissemination of the fungus by means of tools used on diseased trees and then on healthy trees. Results of these studies indicate that such transmission under natural conditions is very unlikely.

Four-year tests on 21 forty-acre blocks have shown that control measures involving isolation and sanitation of diseased trees are inadequate.

This is the first photograph that we know of showing the hyphae of the oak wilt fungus as they actually occur in oak sapwood. In the center of the photo is part of a black oak vessel containing hyphae (note arrows) magnified 150 times.

Economics



FOREST SURVEY

The initial Forest Survey for our region has been completed. We looked briefly at the results on pages 6 through 13. During 1955 we worked on the final report for Ohio. We hope to publish this report some time next year and the final report for Iowa will follow soon thereafter.

It has been 10 years since we began the survey in Missouri so it is time now to begin the maintenance survey so that the data can be kept up to date. Preliminary plans for this resurvey are now underway.

MARKETING

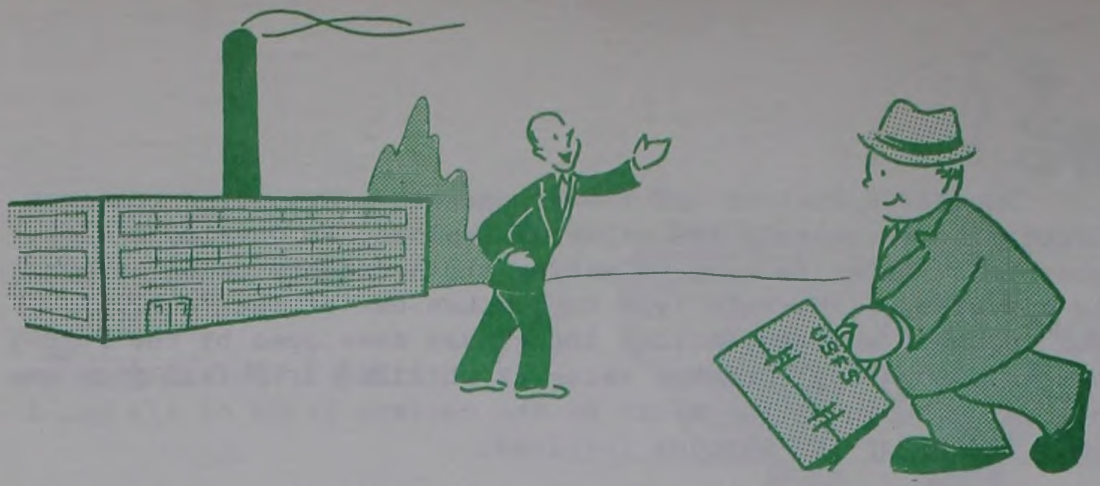
Marketing makes up two-thirds the cost of lumber. So any improvement in methods of selling forest products can result in worthwhile savings to consumers, more income for forest landowners, increased profit to manufacturers, and better competitive advantage for wood over substitute materials.

In 1955 we completed timber market surveys in Iowa and Missouri. We worked with the Ohio Division of Forestry to develop and standardize timber market reports and timber product specifications for that state. In cooperation with the Kentucky Agricultural Experiment Station we published information on timber markets in Kentucky and prepared a leaflet showing farm timber owners the advantages of better timber marketing.

Because foresters and timber operators are often required to determine accurately the value of sawlogs, we developed a Lumber-Value Meter to help in making the necessary calculations. This circular, slide-rule type tool makes use of the "quality index" concept and the factory log grades developed by the Forest Products Laboratory. Lumber value is obtained by multiplying the index value shown on the meter by the current price of 4/4 No. 1 Common lumber of the species involved.

One of the quickest and easiest ways to increase the quality of the timber cut from any stand is to put more care and planning into the bucking operation. For example, the volume of grade 1 logs cut recently on nine commercial logging operations sampled in southern Illinois could have been increased 44 percent by more careful bucking. Although it took 5 percent more bucking cuts to get this increase in grade, the total volume obtained from the improved grade cut was 4 1/2 percent greater than that actually bucked. So the number of bucking cuts required per thousand board-feet remained about the same.

The proposed cut would have resulted in some changes in the distribution of log lengths. The volume of logs less than 12 feet long was increased by 100 percent while the volume of 12- and 14-foot logs was reduced by 18 percent. The volume of 16-foot logs was increased by 60 percent.



Forest Utilization Service

The "FUS" is a service unit devoted to helping wood-using industries throughout the region with their procurement, production, and marketing problems. For several years the staff has consisted of only one man. But late this year, because of the increased demand from industry for advice and consultation, a second man was added. Henceforth, one man will deal solely with primary industries and the other man with secondary. This will result in more and better service to those requesting it.

The Seventh Annual Central States Forestry, Logging, and Sawmilling demonstration was held September 29 and 30 near London, Kentucky. More than 4500 visitors attended the 2-day event and there were 45 registered exhibitors, which made it the largest show held thus far in the Central States as far as volume and character of equipment exhibited and demonstrated are concerned. FUS contributed to this demonstration principally in a consulting capacity.

Assistance was provided a steel strapping company in Chicago in securing native hickory lumber, meeting rigid specifications, for a research project which the company is conducting. During June a local concern producing boxes for the armed forces requested assistance on several problems on proper air seasoning of yellow-poplar. The Extension Forester for Kentucky and one of the District Rangers of the Cumberland National Forest requested advice on converting a hickory handle blank plant into small dimension production for furniture parts. A Columbus, Ohio manufacturer of small toys, anxious to secure small wooden parts, was placed in touch with a tool manufacturer here which is now supplying him with ash and hickory handle rejects. Several established pulp and paper companies and a few prospective producers conferred with FUS and economics staff members on possibilities of expanding this industry in various portions of the Central States. Greatest interest appears to be in Ohio with Indiana and Kentucky close seconds.

1955 Publications

The research job is not done until the results are put in the hands of the people who can use them. We try to publish the results of our work as soon as they are available so that the most benefit can be derived from them. Our material is published through several different media, depending upon the nature of the subject. Some of it is published in technical and professional journals, some in trade journals, some in magazines and newspapers, some is published jointly with our cooperators, and some we publish ourselves.

Our publications for 1955 are listed below. You have probably seen and (we hope) read those that have to do with your particular field. If you would care to have any of the others, we would be happy to send them to you. Those marked with an asterisk (*) are still available. If you are not on our mailing list to receive our publications regularly, we will gladly add your name upon request.

* Brinkman, Kenneth A.
Epicormic branching on oaks in sprout stands. Tech. Paper 146, 8 pp., illus. July.

Buchanan, W. D.
Too many Dent County trees found defective due to bugs, burns and blazes. The Salem Post, Forestry Edition 43(27): 3, illus.

* Central States Forest Experiment Station
Vinton Furnace Experimental Forest. 44 pp., illus., April. (In cooperation with The Baker Wood Preserving Company, McArthur Division.)

Chapman, A. G.
A review of current thinking on Christmas tree grades. Pa. Christmas Tree Growers' Assoc. Bul. 46: 4-6.

* Clark, F. Bryan
Black walnut responds to pruning. Jour. Forestry 53(5): 362-365, illus.

* ---------- and Leney, Lawrence
A homemade caliper for measuring small trees. Jour. Forestry 53(7): 517-518, illus.

Crosby, John S.
Research helps control fires. The Salem Post, Forestry Edition 43(27): 2.

---------- and Fine, Lee C.
More about the tractor-drawn fire rake. Fire Control Notes 16(3): 14-18, illus.

Englerth, George H.
The viability of the oak wilt fungus in red oak lumber. Assoc. South. Agr. Workers Proc. 1955: 108.

* Hay, C. John and Wootten, John F.
Insect damage in hardwood sawlogs. Tech. Paper 148, 14 pp., illus. November.

Herrick, David E.
Skidding resistances in hardwood logging. Northeast. Logger 4(1): 16-17, 37, 48-49, illus.

* ----------
Tractive effort required to skid hardwood logs. Forest Prod. Jour. 5(4): 250-255, illus.

Jones, T. W., and Bretz, T. W.
Radial penetration of the oak-wilt fungus into the boles of diseased trees. Plant Dis. Rptr. 39(11): 872.

* ---------- and Bretz, T. W.
Transmission of oak wilt by tools. Plant Dis. Rptr. 39(6): 498-499.

* Kaeiser, Margaret, and Pillow, Maxon Y.
Tension wood in eastern cottonwood. Tech. Paper 149, 9 pp., illus. November.

* Krajicek, John E.
Rodents influence red oak regeneration. Sta. Note 91, 2 pp. December.

* ----------
A good Norway spruce plantation in Iowa. Sta. Note 90, 1 p., illus. December.

* ----------
Special market makes harvesting low-grade trees profitable. Sho-Me Live Wire 6(6): 10. (Reprint of Sta. Note 87, same title, 1954.)

Lane, Richard D.
Forest research center. South. Alumnus 17(1): 2-4, 18, illus. (Southern Illinois University)

Liming, Franklin G.
The Ozarks forester. Sho-Me Live Wire 6(6): 9-10; 6(7): 12; 6(8): 10; 7(1): 11; 7(2): 11-12; 7(3): 12; 7(3): 4. (Reprint of Misc. Release 7, "Forest problem analysis and research program for the Missouri Ozarks," 1951.)

* ---------- and Clark, F. Bryan
A new pole for measuring small trees. Jour. Forestry 53(4): 288-289, illus.

* Limstrom, G. A., Finn, R. F., and Deitschman, G. H.
Planting stock grades for yellow-poplar. Jour. Forestry 53(1): 28-32, illus.

* Martin, S. Clark
Grazing-forestry relationships in the Missouri Ozarks. Soc. Amer. Foresters Proc. 1954: 203-205, illus.

* ----------
Range problems in the Missouri Ozarks. Misc. Release 9, 33 pp., illus. October.

* ----------
The place of range livestock in the Missouri Ozarks. Jour. Range Mangt. 8(3): 105-111, illus.

Overall forest range management in the Ozarks region. The Ozarks Mountaineer 3(11): 7; 3(12): 10, illus.

* Martin, S. Clark, and Clark, F. Bryan
Control hardwood sprouts with foliage sprays. Sho-Me Live Wire 6(5): 9-10. (Reprint of Tech. Paper 145, "Controlling hardwood sprouts with foliage sprays," 1954.)

* ---------- and Crosby, John S.
Burning and grazing on glade range in Missouri. Tech. Paper 147, 13 pp., illus. September.

* ----------, Dunkeson, Robert L., and Baskett, Thomas S.
Timber harvests help offset forage decline in Missouri's managed forests. Jour. Forestry 53(7): 513-516, illus.

* ---------- and Rogers, Nelson F.
2,4,5-T better than girdling for killing trees. Sta. Note 88, 2 pp., illus. June.

Merz, Robert W.
Some forest and water relations. Assoc. South. Agr. Workers Proc. 1955: 197.

* ----------
Yellow-poplar responds to preplanting ground treatment. Tech. Paper 150, 18 pp., illus. December.

* Minckler, Leon S.
Early growth response of central hardwoods to management. Soc. Amer. Foresters Proc. 1954: 60-65, illus.

* ----------
How tree size affects time needed to prune shortleaf pine. Jour. Forestry 53(9): 665-666, illus.

* ---------- and Roach, Benjamin A.
First steps in managing central hardwood forests. South. Lumberman 191(2393): 119-122, illus.

* Quigley, Kenneth L.
Growing trees grow dollars. Ky. Agr. Expt. Sta. Leaflet 153, 4 pp., illus. May.

* ----------
Markets for forest products in Kentucky. Ky. Agr. Expt. Sta. Bul. 628, 29 pp., illus. June.

* Quigley, Kenneth L.
Ohio's timber harvest revealed in stumps. Forest Survey Release 18, 12 pp., illus. August.

---------- and Rogers, Nelson F.
Teamwork builds post & pole industry in Missouri Ozarks pine forests. Wood Preserving News 33(11): 10-11, 30, illus. (Also printed in part as "New markets for pine in Missouri Ozarks" in Division of Resources and Development Newsletter, Jefferson City, Missouri 7(12): 9-10, illus.)

* Schober, Helen C.
List of publications. Misc. Release 6 (Rev.), 52 pp. January.

* Whitmore, Roy A., and Thornton, Philip L.
Lumber-value meter for central hardwood sawlogs. Sta. Note 89, 2 pp., illus. July. (Also printed in Forest Farmer 15(1): 22.)

Whitten, Russell R.
Dutch elm disease and elm phloem necrosis. Davey Bul. 44(4): 3-4.

Statement on dutch elm disease and elm phloem necrosis. Mist Spraying and Dutch Elm Disease Control, 10 pp.

Transmission of the disease. Control of Dutch Elm Disease, proc. of mtg. sponsored by Ill. State Chamber Com. Nov. 10: 8-14.

Williamson, M. J.
Forest research center studies mountain timber resources. Mountain Life & Work 31(2): 23-26.

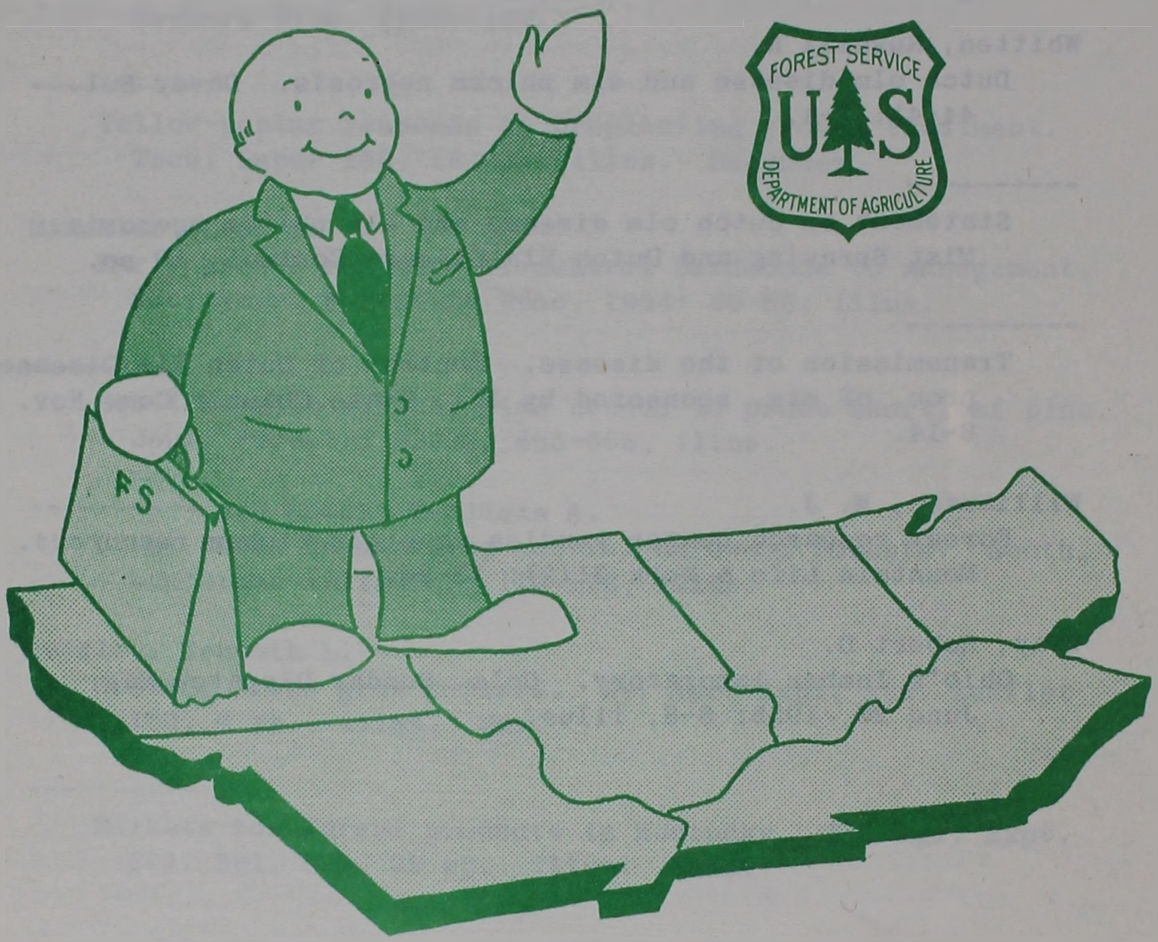
Wray, Robert D.
Ohio's lumber laboratory. Cols. Sunday Dispatch Mag. June 26, 1955: 6-8, illus.

That about does it. In these few pages we've covered -- lightly -- a lot of ground. Naturally, we haven't said all we could have about our history, our problems, or our accomplishments. Nor have we discussed in any detail all of our current work. But we hope that this "Annual Report" has given you a better idea generally of what we're doing, and why we're doing it.

Next year we plan to devote our Annual Report to a more complete and detailed discussion of our current research activities. So until then,

So long,

Informin' Norman



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